

REMARKS

Claims 1-25 were previously pending in this application and claims 26 and 27 are newly added. Claims 1-17 have been rejected and claims 18-25 have been withdrawn from consideration and are hereby cancelled. Claim 3 is hereby cancelled as well. Applicants respectfully request re-examination, reconsideration and allowance of each of pending claims 1, 2, 4-17, 26 and 27 of this application.

i. Cancellation of Claims 18-25

Claims 18-25 were previously withdrawn from consideration and are hereby canceled without prejudice. Applicants reserve the right to prosecute cancelled claims 18-25 in a divisional or other continuation application to be filed at a later date.

ii. Claim Rejections Under 35 U.S.C. § 102

In the Office action, specifically in paragraph 3, claims 1, 3, 4, 6 and 11 were rejected under 35 U.S.C. § 102(e) as being anticipated by Kudo (U.S. Patent No. 6,420,261), hereinafter "Kudo". Applicants respectfully submit that these claim rejections are overcome based on the claim amendments and the remarks set forth below.

Claim 1 is an independent claim, and each of claims 2 and 4-12 depend, directly or indirectly from independent claim 1. Independent claim 1 has been amended to recite the feature that the nitrogen base layer is formed of nitrogen-doped silicon carbide. The cited reference of Kudo does not teach or suggest a nitrogen base layer, or any other layer, formed of nitrogen-doped silicon carbide. Claim 1 is therefore distinguished from Kudo, and, as such, the rejection of claim 1 under 35 U.S.C. § 102(e) as being anticipated by Kudo, should be withdrawn.

Dependent claim 3 has been canceled. Dependent claims 4 and 6 have each been amended for consistency with the amendment to claim 1, from which each of claims 4 and 6 directly depend. Dependent claim 11 also depends directly from amended independent claim 1. Since each of dependent claims 4, 6 and 11 incorporate the features of independent claim 1, which is distinguished from the Kudo reference, dependent claims 4, 6 and 11 are similarly

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distinguished from Kudo and the rejection of claims 4, 6 and 11 under 35 U.S.C. § 102(e), as being anticipated by Kudo, should also be withdrawn.

iii. Rejection of Claims 2, 7, 9, 13 and 14 Under 35 U.S.C. § 103

In the Office action, specifically in paragraph 5, claims 2, 7, 9, 13 and 14 were rejected under 35 U.S.C. § 103(a) as being anticipated by Kudo in view of Huang et al. (U.S. Patent No. 6,191,028), hereinafter "Huang". Applicants respectfully submit that these claim rejections are overcome based on the claim amendments and the remarks set forth below.

As stated above, independent claim 1 has been amended to recite the feature of a nitrogen base layer formed of nitrogen-doped silicon carbide. The cited reference of Huang has apparently been relied upon for teaching that an oxide layer may be formed from TEOS. The cited reference of Huang, however, does not disclose or suggest a nitrogen base layer formed of nitrogen-doped silicon carbide. In fact, the Huang reference does not disclose or suggest any layer formed of nitrogen-doped silicon carbide. The cited reference of Huang therefore does not make up for the deficiencies of Kudo. Amended independent claim 1 is therefore distinguished from the Kudo and Huang references, taken alone or in combination. Claims 2, 7 and 9 depend from claim 1 and claim 9 has been amended for consistency with the amendment to claim 1. Since independent claim 1 is distinguished from the cited references, and further since claims 2, 7 and 9 depend, directly or indirectly, from amended independent claim 1, the rejection of claims 1, 2, 7 and 9 under 35 U.S.C. § 103(a), as being anticipated by Kudo in view of Huang, should be withdrawn.

Independent claim 13 has been amended to recite the feature that "at least one of said barrier layer and said etch-stop layer formed of nitrogen-doped silicon carbide". As above, neither of the Kudo or Huang references disclose or suggest a nitrogen-doped silicon carbide layer. Claim 14 depends directly from claim 13 and thereby incorporates the distinguishing features of claim 13 therein. Since independent claim 13 includes features neither disclosed nor suggested by the Kudo or Huang references, taken alone or in combination, the rejection of claims 13 and 14 under 35 U.S.C. § 103(a), as being anticipated by Kudo in view of Huang, should similarly be withdrawn.

iv. Rejection of Claims 5, 8, 10, 12 and 15-17 Under 35 U.S.C. § 103

In the Office action, specifically in paragraph 6, claims 5, 8, 10, 12 and 15-17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kudo (or Kudo in view of Huang and further) in view of Liu et al. (U.S. Patent No. 6,323,121), hereinafter "Liu". Applicants respectfully submit that these claim rejections are overcome based on the claim amendments and the remarks set forth below.

As above, amended independent claim 1 recites the feature of a nitrogen base layer formed of nitrogen-doped silicon carbide, and amended independent claim 13 recites the feature of "at least one of said barrier layer and said etch-stop layer formed of nitrogen-doped silicon carbide".

Neither of the Kudo or Huang references teach or suggest the feature of a nitrogen-doped silicon carbide. The cited reference of Liu has apparently been relied upon for providing an opening that extends through an etch-stop layer and a lower dielectric layer, as well as the use of organo-silicate glass as low-k dielectric material. Liu, however, does not disclose or suggest nitrogen-doped silicon carbide. Liu therefore does not make up for the stated deficiencies of Kudo in view of Huang. Independent claims 1 and 13 are therefore distinguished from the cited references of Kudo, Huang and Liu, taken alone or in combination.

Claims 5, 8, 10 and 12 each depend, directly or indirectly, from amended independent claim 1 and incorporate the distinguishing features of independent claim 1. Claim 8 has been amended for consistency with the amendment to claim 1. As such, claims 5, 8, 10 and 12 are also distinguished from the references of Kudo, Huang and Liu, and the rejection of claims 5, 8, 10 and 12 under 35 U.S.C. § 103(a), should be withdrawn.

Claims 15-17 each depend, directly or indirectly, from amended independent claim 13, which is distinguished from the cited references of Kudo, Huang and Liu, taken alone or in combination, for reasons set forth above. Since claims 15-17 therefore also incorporate these distinguishing features, claims 15-17 are each also distinguished from the cited references. The rejection of claims 15-17 under 35 U.S.C § 103(a), as being unpatentable over Kudo (or Kudo in view of Huang and further) in view of Liu, should therefore be withdrawn.

v. Newly Added Claims 26 and 27

Claims 26 and 27 have been added to more particularly point out further features of applicants' invention. Newly added claim 26 essentially represents the combination of features that appeared in original claims 1 and 5. Claim 26 is distinguished from the references of record for reasons set forth below.

Claim 26 recites the feature that an oxygen-doped silicon carbide layer is interposed directly between the low-k dielectric layer and the nitrogen base layer. Neither of the references of Kudo, Huang or Liu disclose an oxygen-doped silicon carbide layer, much less an oxygen-doped silicon carbide layer interposed directly between a low-k dielectric layer and a nitrogen base layer. Claim 26 is therefore distinguished from the cited references, taken alone or in combination. Claim 26 is in allowable form.

Dependant claim 27 depends from claim 26 and adds the feature that the nitrogen base layer is formed of nitrogen-doped silicon carbide. As above, this feature is not disclosed by the references of record. Claim 27 is therefore in allowable form.

CONCLUSION

For the foregoing reasons, each of claims 1, 2, 4-17, 26 and 27 is in allowable form and the application is therefore in condition for allowance, which action is respectfully requested.

Attached hereto is a marked-up version of the changes made to the above-identified application by the current amendment. The attached page is captioned "**Version with Markings to Show Changes Made.**"

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By Mark J. Marcelli
Mark J. Marcelli
Reg. No. 36,593
626/795-9900

MJM/dlf

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Please amend claims 1, 4, 6, 8, 9 and 13 as indicated.

1. (Amended) A semiconductor product comprising:
a low-k dielectric layer;
a nitrogen base layer formed of nitrogen-doped silicon carbide and including N-H base groups capable of diffusing therefrom; and
an oxygen-containing layer interposed directly between said low-k dielectric layer and said nitrogen base layer.

4. (Amended) The semiconductor product as in claim 1, wherein said nitrogen base layer comprises one of a ~~[nitrogen-containing]~~ barrier layer film, ~~[a nitrogen-containing]~~ an etch-stop layer, and a hardmask film.

6. (Amended) The semiconductor product as in claim 1, wherein said nitrogen base layer comprises a surface of a further film~~[including N-H base groups thereon]~~.

8. (Amended) The semiconductor product as in claim 7, further comprising each of said barrier layer, said etch-stop layer and said hardmask layer being a nitrogen base layer ~~[including N-H base groups capable of diffusing therefrom]~~, and a TEOS oxide layer interposed between each said nitrogen base layer and each said adjacent low-k dielectric layer.

9. (Amended) The semiconductor product as in claim 7, wherein said barrier layer comprises one of said nitrogen base layer formed of nitrogen-doped silicon carbide₁ and silicon nitride₁; and said etch-stop layer comprises ~~[one]~~ the other of said nitrogen base layer formed of nitrogen-doped silicon carbide₁ and silicon nitride.

13. (Amended) A semiconductor product comprising:
a barrier layer formed over a substrate;
a lower low-k dielectric layer formed over said barrier layer;
an etch-stop layer formed over said lower low-k dielectric layer;
an upper low-k dielectric layer formed over said etch-stop layer;
a hardmask layer disposed over said upper low-k dielectric layer; and
a TEOS (tetraethyl orthosilicate) oxide film interposed at least one of between said lower low-k dielectric layer and said barrier layer, between said lower low-k dielectric layer and said etch-stop layer, between said etch-stop layer and said upper low-k dielectric layer, and between said upper low-k dielectric layer and said hardmask,
at least one of said barrier layer and said etch-stop layer formed of nitrogen-doped silicon carbide.